REMARKS

Claims 1-22 and 24 are pending and stand rejected. Claims 1-17 and 20 have been canceled without prejudice or disclaimer to the subject matter claimed therein. Claim 18 has been amended. New claims 25-42 have been added. The specification has been editorially amended to correct the numbering of the Examples recited in Table I. Applicants respectfully request reconsideration of the rejection in view of the following remarks.

Applicants respectfully submit that support for new claim 28 can be found in Paragraph [058] and in the Karandikar Declaration submitted in the previous reply on November 16, 2005. Applicants respectfully submit that support for new claim 32 can be found in Paragraph [055]. Applicants respectfully submit that support for the rest of the new claims can be found, for example, in former dependent claims 2-17.

The present invention is directed to lightweight, rigid and low thermal-expansion mirrors that could be useful, for example, in semiconductor lithography and space telescopes. A reflecting surface comprising silicon metal is bonded to a substrate that is a composite material featuring coated carbon fibers distributed through a matrix of silicon metal. In one embodiment (independent claim 18), the silicon metal reflecting surface is substantially amorphous. In another embodiment (independent claim 24), the overall substrate has a CTE between -0.46 and +1.75 ppm/K, which is extremely low.

The 35 USC §103 Rejections

Claims 1-9, 12-22 and 24 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,505,805 to Papenburg et al. (hereinafter referred to as "Papenburg") in view of U.S. Patent No. 6,355,340 to Singh et al. (hereinafter referred to as "Singh"). Applicants respectfully traverse this rejection.

To the extent Singh teaches aspects of the claimed invention, such aspects are unavailable against the present application, Applicants respectfully submit. Specifically, the present application is related to Singh through a series (two) of Continuation-in-Part applications. Thus, the affected claims (i.e., those alleged as being unpatentable in view of Singh) of the present application have the effective filing date of Singh.

Papenburg discloses a lightweight mirror structure featuring metallic silicon applied to a CFC or CMC (carbon fiber composite or ceramic matrix composite) substrate. The metallic silicon is in the form of preforms or wafers (col. 8, lines 9-14), but can also be in the form of powder (col. 9, lines 39-49). The CFC substrate consists of a carbon matrix with carbon fiber reinforcement, and is produced by infiltrating resin into a collection of the carbon fibers, and carbonizing the resin (col. 5, lines 65-67). The CFC block or honeycomb structure thus obtained is then further heated, above 2000°C, to at least partially graphitize the carbon matrix and fibers (col. 7, lines 13-16). CMC composites can be produced from the CFC composites by infiltrating refractory and ceramic components into the porous CFC matrix (col. 6, lines 13-16), thereby improving oxidation resistance. For example, Papenburg can cover a surface of a CFC substrate with silicon metal preforms or wafers and then dip the lower end into a pool of molten silicon, which then wicks through the porous CFC substrate, converting it to a CMC substrate, and concurrently bonding the silicon preforms or wafers to the substrate (col. 8, lines 9-23).

Applicants respectfully submit that Papenburg neither discloses nor suggests the invention of independent claim 18 and its dependents directed to a substantially **amorphous** silicon coating. In contrast, what Papenburg says about his silicon is: "The silicon can have an isotropic or polycrystalline structure." (col. 6, lines 31-32) Isotropic means its physical properties are independent of crystallographic direction. Papenburg sheds further light on what he means by "isotropic" in col. 1, lines 36-44. Note that his discussion is limited to "monocrystals" (that is, single crystals) and polycrystalline material. Further up in this column, Papenburg discusses glasses as high-transparency protective coatings (col. 1, lines 24-26), but is silent about amorphous materials in general as a reflective surface itself, let alone amorphous silicon in particular. Singh teaches mirror applications, but again, to the extent Singh discloses what is claimed in the present application, such disclosure is unavailable against the claims of the present application, since the present application is a CIP and the effective filing date of Singh is claimed. Among the advantages of the amorphous coating of the instant invention is that amorphous silicon coatings can be polished to a better finish (e.g., lower surface roughness) than can crystalline silicon coatings. In addition, amorphous silicon reflecting surfaces are less prone to cracking due to CTE mismatch than are polycrystalline and single crystal silicon surfaces, particularly when the CTE of the substrate is below 2 ppm/K.

Applicants respectfully submit that the invention of independent claim 24 and its dependents is also patentable over Papenburg because Papenburg neither discloses nor suggests the claimed substrate having a CTE between -0.46 and +1.75 ppm/K. At the end of Example 2, Papenburg discloses a CTE of about 2 ppm/K (col. 12, lines 63-67). There is nothing in Papenburg to suggest that his other examples produce a different result. The difference of 0.25 ppm/K between Papenburg and the claimed upper CTE limit for the substrate of independent claim 24 is significant because, as stated in Paragraph [021] of the present specification, there are applications where very low or even zero CTE are desirable, if such can be achieved. Thus, at a minimum, the claimed upper limit of about 1.75 ppm/K represents more than a 10% improvement over Papenburg, and this degree of improvement is significant.

The Action stated (or seems to state) that claim 24 is obvious in view of the combined teachings of Papenburg and Singh. Again, to the extent Singh discloses aspects of what is claimed, it is unavailable as a reference. As for Papenburg, in general he has embodiments that disclose ingredients that are similar to those of the claimed invention: carbon fibers in a carbon matrix that is infiltrated with silicon metal. However, differences in properties of the formed CMC composite body, such as CTE, can arise due to a number of factors that may be different between Papenburg and the claimed invention: CTE of the carbon fibers, volume fraction of fibers, amount of porosity, etc. Thus, it is not surprising that the claimed invention can have better (lower) CTE, even though its substrate material superficially has the same general constituents as does Papenburg. To those who would say that reducing CTE is obvious and is simply a matter of design choice, Applicants respectfully submit that if Papenburg could reduce CTE further, he would, since he recognizes the desirability of even lower CTE (see, for example, col. 3, lines 3-5 and lines 36-42). Seemingly, 2 ppm/K is the best that he can do.

Accordingly, Applicants respectfully request that this rejection be withdrawn.

Claims 10 and 11 were rejected under 35 U.S.C. §103(a) as being unpatentable over Papenburg and Singh in view of U.S. Patent No. 5,643,663 to Bommier et al. (hereinafter referred to as "Bommier") for the reasons set forth in the previous rejection. Applicants respectfully traverse this rejection.

Claims 10 and 11, now present as dependent claims 30, 36 and 37, are neither anticipated nor rendered obvious by the references, whether taken individually or in combination. Specifically, and to the extent a reference is available against the present application, Bommier fails to remedy the absence of teaching of a *substantially amorphous silicon reflective* coating, or a *substrate CTE between negative 0.46 and positive 1.75 ppm/K.*

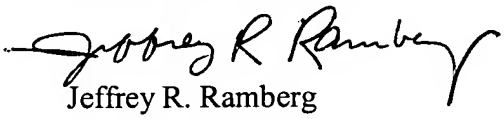
Accordingly, this rejection should be withdrawn.

CONCLUSION

Of central importance to the present invention is the development of a very low CTE substrate material, and a polishable reflective coating for the substrate as embodied by substantially amorphous silicon. These two features permit the fabrication of superior mirrors for demanding environments. In view of the amendments and remarks herein, Applicants respectfully submit that the instant application is in condition for allowance. Accordingly, Applicants respectfully request issuance of a Notice of Allowance directed to claims 18, 19 and 21, 22 and 24-42.

Should the Examiner deem that any further action on the part of Applicants would be desirable, the Examiner is invited to telephone Applicants' undersigned representative.

Respectfully submitted,



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